

SECTION 16120
MEDIUM VOLTAGE POWER CABLE
PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work Included: This Section specifies furnishing, installing and testing of medium voltage power cable.

1. Medium voltage power cable includes the following:
 - a. 15 kV paper insulated lead covered cable (PILC cable).
 - b. Three-conductor ethylene-propylene rubber insulated cable (EPR cable) rated 35 kV for use on Authority 13.8 kV system.

B. Related works are included in, but not limited to, the following Sections:

1. Section 16050: BASIC MATERIALS AND METHODS FOR ELECTRICAL WORK.

1.2 REFERENCES

A. MBTA Standard Specification, attached as Appendix A
P-73D - 4/0 AWG, 3-Phase, Impregnated Paper Insulated Type H Lead Covered Cable

B. Association of Edison Illuminating Companies (AEIC) CS6 standards

C. Insulated Cable Engineers Association (ICEA) S-68-516 standards

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01300, except as modified herein.

B. Product Data/Catalog Cuts

1. Cable
 - a. Include data on manufacturer's cold weather temperature limitations.
2. Stress cones
3. Fire proofing tape

4. Splicing materials

C. Cable Test Reports

1. Manufacturer's standard physical and electrical test reports.

a. Submit test reports prior to shipment of cable from manufacturer.

D. Certificates of Compliance

1. Cable

a. Submit certificates of compliance prior to shipment of cable from manufacturer.

E. Manufacturer's Instructions

1. Cable terminating procedures.

2. Cold weather installation procedures for cable.

3. Cable splicing procedures.

1.3 DELIVERY, HANDLING, TRANSPORTATION, STORAGE AND PROTECTION

A. Delivery, handling, transportation, storage and protection shall be in accordance with Section 01600, except as modified herein.

1. Cable shall be unloaded in a manner such that the unloading equipment used does not come into contact with the cable surface and protective wrap.

2. Cable reels shall be stored on a hard surface so that the flanges do not sink into the soil and allow the weight of the reel and cable to rest on the cable surface.

3. Cable reels shall be stored in an area where construction equipment, falling or flying objects or other material will not come into contact with the cable, and where chemicals, and petroleum products will not be spilled or sprayed on the cable.

4. Cable shall be stored in an area away from open fires and sources of high heat.

5. When a reel of cable is to be rolled from one point to another, the surface over which the reel of cable is to be rolled shall be examined for objects which could contact and damage the cable surface or protective wrap.

a. Remove objects prior to moving the reel of cable.

6. If a length of cable has been cut from the reel, the cable end shall be immediately resealed to prevent the entrance of moisture.

1.4 QUALITY ASSURANCE

A. Environmental Requirements

1. When cables are to be installed in cold weather, the cables shall be stored in a heated area for a minimum of 24 hours prior to installation.
2. Cold weather temperature installations shall be in accordance with the manufacturer's recommendations. Submit manufacturer's cold weather temperature limitation data, including, but not limited to, data on temperature ranges.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A.** The cable shall be suitable for use in wet and dry locations in conduit and underground duct systems.
- B.** The cable shall be rated for 90°C normal, 130°C emergency and 250°C short circuit operating conditions.

2.2 PAPER INSULATED LEAD COVERED CABLE

- A.** PILC cable shall be 4/0, 3-phase, impregnated paper insulated lead covered cable conforming to MBTA Standard Specification P-73D.
- B.** Cable shall be UL listed, and shall be manufactured by Okonite Co., Pirelli Cable, Rome Cable, or approved equal.
- C.** Splicing materials shall be as recommended by the manufacturer and approved by the Engineer.

2.3 ETHYLENE-PROPYLENE RUBBER INSULATED CABLE

- A.** EPR cable shall be 4/0, 3-phase, shielded, ethylene-propylene rubber insulated cable rated 35 kV, 100%, with an overall jacket.
- B.** Basic Construction: Basic construction shall be 3/C Class B strand copper, triple tandem extruded semiconducting ethylene-propylene rubber strand shield insulation-extruded semiconducting ethylene-propylene rubber insulation shield copper shield tape, cabled with fillers and grounding conductor, binder tape and covered with PVC jacket.
- C.** Conductor Shield

1. Conductor shield shall be an extruded layer of semiconducting, EPRI thermosetting compound applied directly over the conductor and shall have a volume resistivity not in excess of 10 ohm meters at 90°C.
2. The compound shall have a minimum elongation after an air oven test at 121°C for 168 hours of 100% and a brittleness temperature not warmer than minus 50°C.

D. Insulation

1. Insulation shall be a red colored flexible thermosetting dielectric based on an ethylene-propylene elastomer. The ethylene content of the elastomer used in the insulation compound shall not exceed 72% by weight of ethylene nor contain polyethylene.
 - a. The insulation shall be compounded by the cable manufacturer in their own facility using a closed system.
 - b. Ingredients shall be mixed, screened through a 120 mesh screen pack and then treated with an accelerator or cross linking agent to insure complete blending and uniformity of the final compound.

E. Insulation Thickness

The minimum average insulation thickness shall be as specified. The minimum thickness at a cross-section of the insulation shall not be less than 90% of the specified minimum average thickness.

Minimum Average		5 Minute AC		15 Minute AC	
<u>Insulation</u>	<u>Thickness, mils</u>	<u>Withstand</u>	<u>kV</u>	<u>Withstand</u>	<u>kV</u>
100%	133%	100%	133%	100%	133%
175	220	35	44	70	80

F. Metallic Shield

1. The insulation semiconducting shield shall be covered with an uncoated copper tape. The uncoated copper tape shall be applied helically with 12.5% overlap.
2. A colored mylar strip, black/red/blue, shall be placed longitudinally under the copper tape for phase identification.

G. Grounding Conductor

1. An equipment grounding conductor of uninsulated copper, stranded, conforming to ASTM B 8, Class B, shall be inserted in the interstices between the black and red conductor and shall be in contact with the

metal shielding tape. The equipment grounding conductor shall be compressed.

H. Jacket

1. A polyvinyl-chloride jacket shall be extruded over the C-L-X sheath.
2. The jacket color shall be red.

2.4 STRESS CONES

- A.** Stress relief cones shall be manufactured by G & W Electric Specialty Co., Thomas & Betts, Raychem, or approved equal.
- B.** Connectors shall be long barrel compression type.
- C.** Cable terminations shall be rated at 15 kV phase to phase.

2.5 FIRE PROOFING TAPE

Fire proofing tape shall be manufactured by 3M Company, Scotch Brand 77; Plymouth Brand Ply-Are; Elastimold, fire and arc proofing tape, or approved equal.

2.6 SOURCE QUALITY CONTROL

- A. Cable Testing**
 1. Cable shall receive the manufacturer's standard physical and electrical tests prior to shipment from the factory. Testing, shall be in accordance with ICEA S-68-516.
 - a. Conductor resistance: In accordance with AEIC, paragraph 1.2
 - b. AC withstand (5 minutes): 15 kV - 44 kV
 - c. IR constant (at 15.6°C), minimum: 50,000 megohms/MFT
 - d. DC withstand (15 minutes): 15 kV - 80 kV

PART 3 - EXECUTION

3.1 INSTALLATION

- A.** The cable installation shall be in accordance with Section 16050, except as modified herein.
- B.** Stress Cones
 1. Stress relief cones shall be made at cable terminations in 15 kV switchgear outdoor load centers and 15 kV switches.

2. Terminations shall be made in accordance with cable manufacturer's instructions, with high-voltage, ozone-resistant self-fusing tape.
3. All terminations and open cables shall be fireproofed with fire proofing tape.

C. Splices will not be permitted in the 15 kV cable, except at designated manholes.

D. Splicing procedures shall be in accordance with the manufacturer's instructions.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Furnishing, installing, testing and commissioning 4/0 PILC AND 4/0 EPR medium voltage power cables (pay item 1612.305), will be measured on a Lump Sum basis, complete in place with all required accessories and incidentals, and shall include all work and materials for a complete and functional installation.

4.2 PAYMENT

4/0 PILC AND 4/0 EPR Medium Voltage Power Cables will be paid for at the Contract Lump Sum Price as specified above and shall include all work and materials for a complete installation.

4.3 PAYMENT ITEMS

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
1612.305	MEDIUM VOLTAGE POWER CABLES LS	

END OF SECTION